U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

9.4.1 CONTROL ROOM AREA VENTILATION SYSTEM

REVIEW RESPONSIBILITIES

Primary - ~~Auxiliary~~ Plant Systems Branch (~~ASB~~SPLB)[1]

Secondary - ~~None~~ Emergency Preparedness and Radiation Protection Branch (PERB)[2]

I. AREAS OF REVIEW

The function of the control room area ventilation system (CRAVS) is to provide a controlled environment for the comfort and safety of control room personnel and to ~~assure~~ support[3] the operability of control room components during normal ~~operating~~ operation,[4] anticipated operational ~~transient~~ occurrences, and[5] design basis accident conditions. Portions of the CRAVS may also be relied upon to support withstanding, or coping with, and recovering from a station blackout event.[6]

The ~~ASB~~SPLB[7] reviews the CRAVS from the air intake to the point of discharge where the system connects to the gaseous cleanup and treatment system or station vents to ~~assure~~ ensure conformance with the requirements of General Design Criteria 2, 4, 5, 19, and 60 and 10 CFR 50.63.[8] The review includes components such as air intakes, ducts, air conditioning units, filters, blowers, isolation dampers ~~or valves~~,[9] and exhaust fans. The review of the CRAVS covers the control room, switchgear and battery room, access control area, control building heating, ventilating, and air conditioning (HVAC) equipment room, and computer room.

1. The ~~ASB~~SPLB[10] reviews the CRAVS to determine the safety significance of the system. Based on this determination, the safety-related portions of the system are reviewed with respect to the functional performance requirements to maintain the habitability of the control room area and other safety-related areas served by the control room ventilation

system during adverse environmental occurrences, during normal operation, anticipated operational occurrences, and subsequent to postulated accidents. The review includes the effects of radiation, combustion and other toxic products, and the coincidental loss of offsite power. The review of this Standard Review Plan (SRP) section is closely associated with the review conducted for SRP Section 6.4, "Control Room Habitability."[11] The ~~ASB~~ SPLB[12] reviews safety-related portions of the system to ~~assure~~ ensure that:

a. A single active failure cannot result in loss of the system functional performance capability.

b. Failures of nonseismic Category I equipment or components will not affect the CRAVS.

2. The ~~ASB also~~ SPLB[13] reviews safety-related portions of the CRAVS with respect to the following:

a. The ability ~~of the control room heating and cooling subsystems~~[14] to maintain a suitable ambient temperature for control room personnel and equipment.

b. The ability to detect, filter, or expedite safe discharge of airborne contaminants inside the control room.

c. The ~~provisions for the detection and isolation of~~ capability to detect the need for isolation and to isolate portions of the system in the event of fires, failures, or malfunctions, and the capability of the system to function under such conditions.[15]

d. The ability of essential equipment being serviced by the ventilation system to function under the worst anticipated degraded CRAVS performance.

e. The capability to actuate components not normally operating that are required to operate during accident conditions, and to provide necessary isolation.[16]

3. The SPLB reviews the expected environmental conditions in areas served by the CRAVS and the extent, if any, to which the CRAVS is relied upon to function for a station blackout event.[17]

Review Interfaces[18]

~~3.~~ The ~~ASB also~~ SPLB also[19] performs the following reviews as part of its primary review responsibility[20] under the SRP sections indicated:

a. Review of flood protection is performed under SRP Section 3.4.1.

b. Review of the protection against internally generated missiles is performed under SRP Section 3.5.1.1.

c. Review of the structures, systems, and components to be protected against externally generated missiles is performed under SRP Section 3.5.2.

d. Review of high- and moderate-energy pipe breaks is performed under SRP Section 3.6.1.

e. Review of the environmental qualification of mechanical and electrical components is performed under SRP Section 3.11.[21]

f. Review of the concentrations of airborne contaminants in the vicinity of the intake and exhaust vents resulting from accidental release on the plant site and the capability of the system to maintain control room habitability is performed under SRP Section 6.4.[22]

g. Review of the effectiveness of the CRAVS filters to remove airborne contaminants prior to discharge to the environment is performed under SRP Section 6.5.1.[23]

h. Review of fire protection is performed under SRP Section 9.5.1.[24]

~~1.~~ The ~~ASB~~SPLB[25] will coordinate evaluations performed by other branches that interface with SPLB to complete[26] the overall evaluation of the system as follows:

a. The Instrumentation and Controls ~~Systems~~ Branch (~~ICSB~~HICB[27]) and ~~Power Systems Branch (PSB)~~ the Electrical Engineering Branch (EELB)[28] determine the adequacy of the design, environmental ratings, installation, inspection, and testing of ~~all essential~~instrumentation and electrical components, equipment, and systems (sensing, control, and power) ~~required for proper operation~~ as part of their primary review responsibility for SRP ~~Sections 7.3 and 8.3.1~~Chapters 7 and 8, respectively. The EELB also performs the overall review of compliance with station blackout requirements, as part of its primary review responsibility for SRP Section 8.4 (proposed).[29]

b. The ~~Structural Engineering Branch (SEB)~~ Civil Engineering and Geosciences Branch (ECGB)[30] determines the acceptability of the design analyses, procedures, and criteria used to establish the ability of seismic Category I structures housing the system and supporting systems to withstand the effects of natural phenomena such as the safe shutdown earthquake (SSE), the probable maximum flood (PMF), and tornado missiles as part of its primary review responsibility for SRP Sections 3.3.1, 3.3.2, 3.5.3, 3.7.1 through 3.7.4, 3.8.4, and 3.8.5. The ECGB also verifies that inservice inspection requirements are met for system components as part of its primary review responsibility for SRP Section 6.6.[31]

c. The Mechanical Engineering Branch (~~MEB~~EMEB)[32] determines that the components, piping, and structures are designed in accordance with applicable codes and standards as part of its primary review responsibility for SRP Sections 3.9.1 through 3.9.3.

d. The ~~MEB also~~ EMEB[33] determines the acceptability of the seismic and quality group classifications for system components as part of its primary review responsibility for SRP Sections 3.2.1 and 3.2.2.

e. The ~~MEB also~~ EMEB[34] reviews the adequacy of the inservice testing program of pumps and valves as part of its primary review responsibility for SRP Section 3.9.6.

f. The EMEB and HICB review the seismic qualification of Category I instrumentation and electrical equipment as part of their primary and secondary review responsibilities, respectively, for SRP Section 3.10.[35]

~~g. The Materials Engineering Branch (MTEB) verifies that inservice inspection requirements are met for system components as part of its primary review responsibility for SRP Section 6.6.~~

~~The review for Fire Protection, Technical Specifications, and Quality Assurance are coordinated and performed by the Chemical Engineering Branch, Licensing Guidance Branch, and Quality Assurance Branch as part of their primary review responsibility for SRP Sections 9.5.1, 16.0, and 17.0, respectively.~~[36]

g. The PERB evaluates the radiation protection criteria as part of its primary review responsibility for SRP Section 12.3-4.[37]

h. The Technical Specifications Branch (TSB) coordinates and performs reviews of the proposed technical specifications as part of its primary review responsibility for SRP Section 16.0.[38]

i. The Quality Assurance and Maintenance Branch (HQMB) coordinates and performs reviews of quality assurance programs as part of its primary review responsibility for SRP Chapter 17.[39]

~~The Effluent Treatment Systems Branch (ETSB) evaluates the effectiveness of the system filters to remove airborne contaminants prior to discharge to the environment as part of its primary review responsibility for SRP Section 6.5.1.~~[40]

~~The Accident Evaluation Branch (AEB) evaluates the concentrations of airborne contaminants in the vicinity of the intake and exhaust vents resulting from accidental release on the plant site and evaluates the capability of the system to maintain control room habitability as part of its primary review responsibility for SRP Section 6.4.~~[41]

~~The Equipment Qualification Branch (EQB) reviews the seismic qualification of Category I electrical components and the environmental qualification of mechanical and electrical components as part of its primary review responsibility for SRP Sections 3.10 and 3.11, respectively.~~[42]

For those areas of review identified above as being ~~reviewed as part of the primary review responsibility of other branches~~part of the review under other SRP sections, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP sections ~~of the corresponding primary branch~~.[43]

II. ACCEPTANCE CRITERIA

Acceptability of the CRAVS design, as described in the applicant's safety analysis report (SAR) is based on relevant regulations,[44] specific general design criteria, and regulatory guides.

The design of safety-related portions of the CRAVS is acceptable if the integrated design of the system is in accordance with the following criteria:

1. General Design Criterion 2 (GDC 2), "Design Bases for Protection Against Natural Phenomena,"[45] as related to the system being capable of withstanding the effects of earthquakes. Acceptance is based on meeting the guidance of Regulatory Guide 1.29, position C.1 for safety-related portions and position C.2 for nonsafety-related portions.

2. General Design Criterion 4 (GDC 4), "Environmental and Dynamic Effects Design Bases," with respect to the CRAVS being appropriately protected against dynamic effects and being designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated ~~maintaining environmental conditions in the control room compatible with the design limits of essential equipment located therein during normal, transient, and~~ accident ~~conditions~~.[46] The evaluation with respect to GDC 4 also includes evaluation of the adequacy of environmental support provided to structures, systems, and components important to safety located within areas served by the CRAVS.[47]

3. General Design Criterion 5 (GDC 5), "Sharing of Structures, Systems, and Components,"[48] as related to shared systems and components important to safety.

4. General Design Criterion 19 (GDC 19), "Control Room,"[49] as related to providing adequate protection to permit access and occupancy of the control room under accident conditions. Acceptance is based on meeting the guidance of Regulatory Guide 1.78 relating to instrumentation to detect and alarm any hazardous chemical release in the plant vicinity and relating to the systems capability to isolate the control room from such releases and the systems capability to meet the single failure criterion, positions C.3, C.7, and C.14, respectively; and Regulatory Guide 1.95 relating to the systems capability to limit the accumulation of chlorine within the control room and the systems capability to meet the single failure criterion, positions C.4.a and C.4.d.

~~Regulatory Guide 1.95 relating to the systems capability to limit the accumulation of chlorine within the control room and the systems capability to meet the single failure criterion, positions C.4a and C.4d.~~[50]

5. General Design Criterion 60 (GDC 60), "Control of Release of Radioactive Materials to the Environment,"[51] as related to the systems capability to suitably control release of

gaseous radioactive effluents to the environment. Acceptance is based on meeting the guidance of Regulatory Guides 1.52 and 1.140, as related to design, testing, and maintenance criteria for atmosphere cleanup system and normal ventilation exhaust system air filtration and adsorption units of light-water-cooled nuclear power plants, position C.2, and positions C.1 and C.2, respectively.

6. 10 CFR 50.63 as related to necessary support systems providing sufficient capacity and capability for coping with a station blackout event. An analysis to determine capability for withstanding (if an acceptable alternate ac source is provided) or coping with a station blackout event is required. The analysis should address, as appropriate, the potential failures of equipment/systems during the event (e.g., loss of or degraded operability of HVAC systems, including the CRAVS, as appropriate), the expected environmental conditions associated with the event, the operability and reliability of equipment necessary to cope with the event under the expected environmental conditions, and the habitability of plant areas requiring operator access during the event and associated recovery period. Acceptance is based on meeting the applicable guidance of Regulatory Guide 1.155, including position C.3.2.4.[52]

Technical Rationale[53]

The technical rationale for application of these acceptance criteria to reviewing the CRAVS is discussed in the following paragraphs:[54]

1. Compliance with GDC 2, as related to the system being capable of withstanding the effects of earthquakes, requires that structures, systems, and components important to safety be designed to withstand the effects of a design basis earthquake without loss of capability to perform their safety functions.

   The function of the CRAVS is to provide a controlled environment for the comfort and safety of control room personnel during normal operation, anticipated operational occurrences, and during and after postulated accidents, including the coincidental loss of offsite power. This requirement is imposed to ensure that the control room will remain functional in the event of a design basis earthquake. Regulatory Guide 1.29 provides guidance acceptable to the staff for meeting these control room occupancy protection requirements.

   Meeting the requirement of GDC 2 provides assurance that the habitability of the control room area will be maintained and that equipment in the control room will operate as designed, thereby minimizing the potential for loss of function.[55]

2. Compliance with GDC 4 requires that structures, systems, and components important to safety be designed to accommodate the effects of, and to be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. GDC 4 also requires that structures, systems, and components important to safety be appropriately protected against dynamic effects (including those of missiles, pipe whipping, and discharging

fluids) that could result from equipment failures or from events and conditions outside the nuclear power unit.

The function of the CRAVS is to provide a suitable and controlled environment for the control room during normal operation, anticipated operational occurrences, and during and after postulated accidents, including loss of offsite power. To ensure performance of these functions under accident conditions, portions of the CRAVS must be designed to accommodate accident environmental effects and be appropriately protected from dynamic effects associated with postulated accidents. The requirements of GDC 4 are imposed to ensure that control room area systems and components important to safety (with environmental support from the CRAVS) and safety-related portions of the CRAVS are designed to address the expected environmental conditions and dynamic effects associated with the specified events and conditions for which they are required to function.

Meeting the requirements of GDC 4 provides assurance that the control room area ventilation system will support the functioning of systems and components important to safety by providing and maintaining suitable environmental conditions for performance of safety functions.[56]

3. Compliance with GDC 5 requires that structures, systems, and components important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

With regard to the CRAVS, GDC 5 requires the component parts of the CRAVS be essentially independent in order to ensure that an accident in one unit of a multiple-unit facility will not propagate to other units. Therefore the CRAVS for each unit should be designed to accommodate the load resulting from accident conditions. At the same time, the operating environment of equipment in the control room(s) of the unaffected unit(s) must be maintained within specified limits.

Meeting the requirements of GDC 5 provides assurance that a failure or accident in one unit will not affect additional units of a multiple-unit site.[57]

4. Compliance with GDC 19 requires that the control room remain functional to the degree that actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain the plant in a safe condition under accident conditions, including loss-of-coolant accidents.

With regard to the CRAVS, GDC 19 requires that adequate protection against radiation and hazardous chemical releases be provided to permit access to and occupancy of the control room under accident conditions. Regulatory Guides 1.78 and 1.95 provide guidance acceptable to the staff for meeting these control room occupancy protection requirements.

Meeting the requirements of GDC 19 provides assurance that access to and occupancy of the control room will be protected under accident conditions.[58]

5. Compliance with GDC 60 requires that the nuclear power unit design include provisions to control the release of radioactive materials entrained in gaseous effluents during normal reactor operation, including anticipated operational occurrences.

Regulatory Guides 1.140 and 1.52 offer design, testing, and maintenance criteria acceptable to the staff for air filtration and adsorption units of normal ventilation exhaust systems and for atmosphere cleanup systems in light-water-cooled nuclear power plants. Atmosphere cleanup systems are included in the design to reduce the quantities of radioactive materials entrained in gaseous effluents that are released to the environment.

Meeting the requirements of GDC 60 provides assurance that release of radioactive materials entrained in gaseous effluents will not exceed the limits specified in 10 CFR Part 20 for normal operation and anticipated operational occurrences.[59]

6. Compliance with 10 CFR 50.63 requires a demonstration of the capability of a nuclear power plant to withstand and recover from a station blackout (i.e., loss of offsite electric power system concurrent with reactor trip and unavailability of the onsite emergency ac electric power system). A station blackout analysis covering a minimum acceptable duration (either to withstand the event until an alternate ac source and shutdown systems are lined up for operation or to cope with it for its duration, including the associated recovery period) is required. Regulatory Guide 1.155 provides guidance for complying with station blackout requirements.

Regardless of the extent, if any, to which the CRAVS is expected to function to maintain suitable environmental conditions during a station blackout event, control room-area equipment that is necessary to accomplish core cooling, maintenance of appropriate containment integrity, and other functions that constitute withstanding and/or coping during the event should be capable of functioning under the expected environmental conditions associated with the event. The station blackout analysis is therefore verified to appropriately address the potential failures of equipment/systems during the event (e.g., loss of or degraded operability of the CRAVS, as appropriate), the expected environmental conditions associated with the event, the operability and reliability of equipment necessary to cope with the event under the expected environmental conditions, and the habitability of plant areas requiring operator access during the event and associated recovery period.

Those portions of the CRAVS, if any, that are identified in a coping analysis as necessary to support the functioning of equipment required to cope with the event or recovery therefrom are verified to be of sufficient capacity and capability to provide such support.

Meeting the requirements 10 CFR 50.63 provides assurance that necessary operator actions can be performed and that necessary control room-area equipment will be functional under the expected environmental conditions during and following a station

blackout, thereby ensuring that the core will be cooled and appropriate containment integrity will be maintained.[60]

III. REVIEW PROCEDURES

The procedures below are used during the construction permit (CP) or standard design certification[61] review to determine that the design criteria and bases and the preliminary design as set forth in the preliminary ~~safety analysis report~~SAR[62] meet the acceptance criteria given in subsection II of this SRP section.

For the review of operating license (OL)[63] or combined license (COL)[64] applications, the procedures are used to verify that the initial design criteria and bases have been appropriately implemented in the final design as set forth in the final ~~safety analysis report~~SAR.[65]

The procedures for standard design certification reviews of designs for which new standard technical specifications are required and for OL or COL include a determination that the proposed technical specifications are in agreement with the requirements for system testing, minimum performance, and surveillance developed as a result of the staff's review.[66]

The primary reviewer will coordinate this review with the other areas of review as stated in subsection I of this SRP section. The primary reviewer obtains and uses such input as required to ~~assure~~ ensure that this review procedure is complete.

As a result of various CRAVS designs proposed by applicants, there will be variations in system requirements. For the purpose of this SRP section, a typical system with redundant subsystems is assumed with each subsystem having an identical essential (safety features) portion. For cases where there are variations from this typical arrangement, the reviewer would adjust the review procedures given below. However, the system design would be required to meet the acceptance criteria given in subsection II of this SRP section. The reviewer will select and emphasize material from this SRP section as may be appropriate for a particular case.

1. The SAR is reviewed to verify that the system description and piping and instrumentation diagrams (P&IDs) show the CRAVS equipment used for normal and emergency operations, and the ambient temperature limits for the areas serviced. The system performance requirements section is reviewed to determine that it describes allowable component operational degradation (e.g., loss of cooling function, damper leakage) and describes the procedures that will be followed to detect and correct these conditions. The reviewer, using results from failure modes and effects analyses as appropriate,[67] determines that the safety-related portion of the system is capable of functioning in spite of the loss of any active component.

   For new applications, the system review should also verify conformance with ASME Code AG-1, "Code on Nuclear Air and Gas Treatment" including the AG-1a-92 Addenda (Reference 13).[68]

2. The system P&IDs, layout drawings, and component descriptions and characteristics are then reviewed to determine that:

a. Essential portions of the CRAVS are correctly identified and are isolable from nonessential portions of the system. The P&IDs are reviewed to verify that they clearly indicate the physical divisions between such portions and indicate design classification changes. System drawings are also reviewed to verify that they show the means for accomplishing isolation and the system description is reviewed to identify minimum performance requirements for the isolation dampers.

For the typical system, the drawings and description are reviewed to verify that two automatically operated isolation dampers in series separate nonessential portions and components from the essential portions.

b. Essential portions of the CRAVS, including the isolation dampers separating essential from nonessential portions are classified seismic Category I. Component and system descriptions in the SAR that identify mechanical and performance characteristics are reviewed to verify that the above classifications have been included and that the P&IDs indicate any points of change in design classification. ~~The review for seismic design is performed by SEB and the review for seismic and quality group classification is performed by MEB as indicated in Subsection I of the SRP section.~~[69]

c. Design provisions have been made that permit appropriate inservice inspection and functional testing of system components important to safety. It is acceptable if the SAR information delineates a testing and inspection program and if the system drawings show the necessary test recirculation loops around pumps or isolation valves that would be required by this program.

3. The reviewer verifies that the system has been designed so that system function will be maintained as required in the event of adverse environmental phenomena, hazardous chemical release in the plant vicinity,[70] or loss of offsite power. The reviewer evaluates the system, using engineering judgment and the results of failure modes and effects analyses to determine that:

a. ~~The failure of nonessential portions of the system or of other nonessential systems, structures, or components located close to essential portions of the system will not preclude operation of the essential portions of the CRAVS.~~ The failure of nonessential portions of the systems or of other systems not designed to seismic Category I standards and located close to essential portions of the system, or of nonseismic Category I structures that house, support, or are close to essential portions of the CRAVS, will not preclude operation of the essential portions of the CRAVS.[71] Reference to SAR sections describing site features and the general arrangement and layout drawings will be necessary, as well as the SAR tabulation of seismic design classifications for structures and systems. Statements in the SAR that verify that the above conditions will be met are acceptable ~~at the CP stage~~.[72]

b. The essential portions of the CRAVS are protected from the effects of floods, hurricanes, tornadoes, and internally ~~or~~ and[73] externally generated missiles. Flood protection and missile protection criteria are discussed and evaluated in detail under the Section 3 series of the SRP. The location and the design of the system, structures, and ~~pump~~ fan[74] rooms (cubicles) are reviewed to determine that the degree of protection is adequate. A statement to the effect that the system is located in a seismic Category I structure that is tornado missile and flood protected, or that components of the system will be located in individual ~~seismic Category I~~[75] cubicles or rooms that will withstand the effects of both flooding and missiles is acceptable.

c. The CRAVS will maintain control room habitability in the event of release of airborne contamination that may enter the control room via the intake vents. Final determination of the identification and the concentration of the contaminants will be completed at the OL or COL stage of review.[76]

~~c~~d. The total system has the capability to detect and control leakage of airborne contamination into the system. It is acceptable if the following conditions are met:

(1) The system P&IDs show monitors located in the system intakes that are capable of detecting radiation, smoke, and toxic chemicals. The monitors should actuate alarms in the control room.

(2) The capability for isolation of nonessential portions of the CRAVS by two automatically actuated dampers in series is shown on the P&IDs.

(3) The CRAVS has provisions for an internal recirculation filtering mode of operation or can discharge airborne contaminants from the control room area using a once-through ventilation mode, as applicable.

(4) Provisions for isolation of the control room upon smoke detection at the air intakes are shown on the P&IDs. The isolation may be actuated manually for most cases. Automatic isolation may be required in special cases such as for fires resulting from aircraft crashes.

~~d~~e. Essential components and subsystems can function as required in the event of loss of offsite power. The system design will be acceptable if the CRAVS meets minimum system requirements as stated in the SAR assuming a failure of a single active component within the system itself or in the auxiliary electric power source which supplies the system. The SAR is reviewed to see that for each CRAVS component or subsystem affected by the loss of offsite power, the resulting system operation will not affect safety of control room personnel or the performance of any essential equipment. Statements in the SAR and the results of failure modes and effects analyses are considered in verifying that the system meets these requirements. This will be an acceptable verification of system functional reliability.

4. The descriptive information, P&IDs, CRAVS drawings, and failure modes and effects analyses in the SAR are reviewed to ~~assure~~ ensure that essential portions of the system can function following design basis accidents assuming a concurrent single active failure. The reviewer evaluates the analyses presented in the SAR to ~~assure~~ ensure function of required components, traces the availability of these components on system drawings, and checks that the SAR contains verification that minimum system isolation or filtration requirements are met for each accident situation for the required time spans. For each case the design will be acceptable if minimum system requirements are met.

5. The reviewer verifies that a suitable environment is demonstrated to be maintained in areas served by the CRAVS for the duration of a station blackout event and the associated recovery period with or without credit for CRAVS operation, as applicable. Where applicable, the functionality of equipment necessary to cope with the event under the expected environmental conditions and the habitability of areas where operator actions are performed should be appropriately addressed during the review as described in Regulatory Guide 1.155, position C.3.2.4. Where the CRAVS (or portions thereof) is credited to function for coping with a station blackout, the reviewer verifies that the CRAVS has been designed so that system functions will be performed as required in the event of a station blackout, that the CRAVS has sufficient capacity and capability to maintain a suitable environment for the duration of a station blackout event and the associated recovery period, and that failure of non-required portions of the CRAVS will not adversely affect the functioning of required equipment. As necessary, the reviewer interfaces with HICB and EELB reviewers as described in subsection I to evaluate the instrumentation and electrical provisions for CRAVS functionality in the event of a station blackout and also to ensure that appropriate control room-area instrumentation and electrical equipment environmental limits have been considered.[77]

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[78]

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and ~~his~~ that the[79] review supports conclusions of the following type, to be included in the staff's safety evaluation report (SER):[80]

> The control room area ventilation system (CRAVS) includes all components and ducting from the intake vents to the exhaust structure. All portions of the system whose failure may result in release of radioactivity which causes an offsite dose of more than 5 mSv (0.5 rem)[81] to the whole body or its equivalent to any part of the body are classified seismic Category I and safety related. Based on the review of the applicant's proposed design criteria, the design bases, and safety classification for the control room

area ventilation system, and the requirements for system performance to maintain a suitable environment during normal, abnormal, and accident conditions, the staff concludes that the design of the control room area ventilation system and auxiliary supporting systems is in conformance with the Commission's regulations as set forth in General Design ~~Criteria~~ Criterion 2, "Design Bases for Protection Against Natural Phenomena";[82] General Design Criterion 4, "Environmental and Dynamic Effects Design Basis";[83] General Design Criterion 5, "Sharing of Structures, Systems, and Components";[84] General Design Criterion 19, "Control Room";[85] ~~and~~ General Design Criterion 60 "Control of Releases of Radioactive Materials to the Environment";[86] and 10 CFR 50.63.[87] This conclusion is based on the following:

1. The applicant has met the requirements of General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," with respect to the system being capable of withstanding the effects of earthquakes by meeting the guidelines of Regulatory Guide 1.29, "Seismic Design Classification," position C.1 for safety-related portions of the system and position C.2 for nonsafety-related portions of the system.

2. The applicant has met the requirements of General Design Criterion 4, "Environmental and ~~Missile~~Dynamic Effects[88] Design Basis," by appropriately addressing adverse environmental conditions and dynamic effects in the design of the system to ensure its capability for maintaining environmental conditions in the control room within the design limits of ~~the essential~~ equipment important to safety located therein for normal, transient, or accident conditions.[89]

3. The applicant has met the requirements of General Design Criterion 5, "Sharing of Structures, Systems, and Components ~~Important to Safety to Perform Required Safety Functions~~,"[90] with respect to capability of shared systems and components important to safety to perform required safety functions.

4. The applicant has met the requirements of General Design Criterion 19, "Control Room," with respect to the capability of the system to maintain a suitable environment in the control room for occupancy during normal and accident conditions by meeting the guidelines of Regulatory Guide 1.78, "Assumptions for Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release," positions C.3, C.7, and C.14, and Regulatory Guide 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release," positions C.4.a and C.4.d.

5. The applicant has met the requirements of General Design Criterion 60, "Control of Releases of Radioactive Materials to the Environment," with respect to the capability of the system to suitably control release of gaseous radioactive effluents to the environment by meeting the guidelines of Regulatory Guide 1.52, "Design, Testing, and Maintenance Criteria for Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants," position C.2~~.~~; and Regulatory Guide 1.140, "Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants," positions C.1 and C.2.

6. The applicant has met the requirements of 10 CFR 50.63 by demonstrating that suitable environmental conditions to support operator access/egress and equipment functionality will be maintained during a station blackout event and its associated recovery period in those areas of the control room which contain equipment whose function is required for the safe shutdown of the plant in the event of a station blackout and by meeting the applicable guidance of Regulatory Guide 1.155.[91]

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP section.[92]

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[93] Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[94]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides.

VI. REFERENCES

1. 10 CFR 50.63, "Loss of All Alternating Current Power."[95]

~~1~~2. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

~~2~~3. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and ~~Missile~~Dynamic Effects[96] Design Bases."

~~3~~4. 10 CFR Part 50, Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components."

~~4~~5. 10 CFR Part 50, Appendix A, General Design Criterion 19, "Control Room."

~~5~~6. 10 CFR Part 50, Appendix A, General Design Criterion 60, "Control of Releases of Radioactive Materials to the Environment."

~~6~~7. Regulatory Guide 1.29, "Seismic Design Classification."

~~7~~8. Regulatory Guide 1.52, "Design, Testing and Maintenance Criteria for Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants."

~~8~~9. Regulatory Guide 1.78, "Assumptions for Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release."

~~9~~10. Regulatory Guide 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release."

~~10~~11. Regulatory Guide 1.140, "Design, Testing and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants."

12. Regulatory Guide 1.155, "Station Blackout."[97]

13. ASME Code AG-1, "Code for Nuclear Air and Gas Treatment," 1991 (including the AG-1a-92 Addenda thereto).[98]

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SRP Draft Section 9.4.1
Attachment A - Proposed Changes in Order of Occurrence

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	Current PRB name and abbreviation	Change PRB to Plant Systems Branch (SPLB).
2.	Current SRB name and abbreviation	Added SRB, Emergency Preparedness and Radiation Protection Branch (PERB).
3.	Editorial	Changed assure to ensure. (Global change for this section.)
4.	Editorial	Changed operating to operation to correct grammar.
5.	SRP-UDP format item	Implementation of Generic Issue B-3, "Event Categorization."
6.	Integrated Impact No. 325	Added reference to station blackout. Also clarified that the CRAVS may or may not be credited to function during an SBO (i.e., is not firmly required to function for SBO and is not necessarily assumed to function during SBO).
7.	Current PRB abbreviation	Changed PRB to SPLB.
8.	Integrated Impact No. 325	Added reference to 10 CFR 50.63.
9.	Editorial	Deleted to conform to SRP Sections 9.4.2, 9.4.3, and 9.4.4.
10.	Current PRB abbreviation	Changed PRB to SPLB.
11.	Editorial	Added reference to SRP Section 6.4, "Control Room Habitability."
12.	Current PRB abbreviation	Changed PRB to SPLB.
13.	Current PRB abbreviation	Changed PRB to SPLB.
14.	Editorial	Deleted system name because it is redundant.
15.	Editorial	Changed to conform to SRP Sections 9.4.2, 9.4.3, and 9.4.4.
16.	Editorial	Added to conform to SRP Sections 9.4.3 and 9.4.4.
17.	Integrated Impact No. 325	Added station blackout as a PRB review responsibility and renumbered subsequent paragraphs. Also clarified that the CRAVS may or may not be credited to function during an SBO (i.e., is not firmly required to function for SBO and is not necessarily assumed to function during SBO).

Item	Source	Description
18.	SRP-UDP format item	Added "Review Interfaces" to AREAS OF REVIEW and organized in numbered paragraph form to describe how other SRP sections interface with SRP Section 9.4.1 and how other branches support the SPLB review.
19.	Current PRB abbreviation	Changed PRB to SPLB.
20.	Editorial	Added clarifying phrase.
21.	Current PRB responsibility	Changed to reflect SPLB review responsibility for SRP Section 3.11.
22.	Current PRB responsibility	Changed to reflect SPLB review responsibility for SRP Section 6.4.
23.	Current PRB responsibility	Changed to reflect SPLB review responsibility for SRP Section 6.5.1.
24.	Current PRB responsibility	Changed to reflect PRB review responsibility for SRP Section 9.5.1.
25.	Current PRB abbreviation	Changed PRB to SPLB.
26.	Editorial	Changed to conform to SRP Section 9.4.2.
27.	Current review branch responsibility	Changed to reflect HICB review responsibility for SRP Chapter 7.
28.	Current review branch responsibility	Changed to reflect EELB review responsibility for SRP Chapter 8.
29.	Integrated Impact No. 325	Added reference to the station blackout rule. Added reference to proposed SRP Section 8.4 for review of SBO issues. Also revised the interface to reflect not only I&C and electrical reviews associated with operation of the CRAVS but also reviews of I&C and electrical components, equipment, and systems located in areas served by the CRAVS. This change was made because SRP Section 9.4.1 includes reviews of the adequacy of environmental support provided by the CRAVS to SSCs important to safety under specified conditions/events. The adequacy of environmental support must be evaluated with respect to I&C and electrical component and equipment specifications, ratings, etc.
30.	Current review branch responsibility	Changed to reflect ECGB review responsibility for SRP Sections 3.3.1, 3.3.2, 3.5.3, 3.7.1 through 3.7.4, 3.8.4, and 3.8.5.
31.	Current PRB review responsibilities	Relocated former interface g with MTEB to reflect that ECGB is now responsible for this review.
32.	Current review branch responsibility	Changed to reflect EMEB review responsibility for SRP Sections 3.9.1 through 3.9.3.

Item	Source	Description
33.	Current review branch responsibility	Changed to reflect EMEB review responsibility for SRP Sections 3.2.1 and 3.2.2.
34.	Current review branch responsibility	Changed to reflect EMEB review responsibility for SRP Section 3.9.6.
35.	Current review branch responsibility	Changed to reflect EMEB review responsibility for SRP Section 3.10.
36.	Current review branch names and responsibilities	Deleted to move review responsibility of SPLB for SRP Section 9.5.1, TSB for SRP Section 16.0, and HQMB for SRP Chapter 17 elsewhere. Also relocated former interface g regarding inservice inspection to the discussion of ECGB reviews.
37.	Current SRB review responsibility	Added PERB responsibility for SRP Section 12.3-4 to conform to SRP Sections 9.4.2, 9.4.3, and 9.4.4.
38.	Current review branch responsibility	Added to reflect TSB review responsibility for SRP Section 16.0.
39.	Current review branch responsibility	Added to reflect HQMB review responsibility for SRP Chapter 17.
40.	SRP-UDP format item	Deleted paragraph to reflect current SRP format.
41.	SRP-UDP format item	Deleted paragraph to reflect current SRP format.
42.	SRP-UDP format item	Deleted paragraph to reflect current SRP format.
43.	Editorial	Simplified for clarity and readability.
44.	Editorial	Added regulations as one of the bases for acceptance criteria.
45.	Editorial	Added abbreviation and title of GDC 2.
46.	Editorial	Revised sentence to reflect the current relevant requirements of GDC 4 as reflected in the review of the CRAVS design adequacy as described in subsection III where the CRAVS is verified to be functional under adverse environmental conditions and protected from floods, missiles, etc. Also, added abbreviation and Title of GDC 4.
47.	Editorial	Revised clarification that the review for compliance with GDC 4 also includes evaluation of CRAVS auxiliary support functions to provide a suitable environment for SSCs important to safety located within the area served by the CRAVS, consistent with Review Procedures described in subsection III and Evaluation Findings described in subsection IV.
48.	Editorial	Added abbreviation and title of GDC 5.
49.	Editorial	Added abbreviation and title of GDC 19.

Item	Source	Description
50.	Editorial	Deleted because RG 1.95 is not an acceptance criterion.
51.	Editorial	Added abbreviation and title of GDC 60.
52.	Integrated Impact No. 325	Added 10 CFR 50.63 as an acceptance criterion. Also added reference to position C.3.2.4 of RG 1.155 which provides guidance for addressing the environmental conditions resulting from an SBO event in the evaluation of coping capability. Based upon the above requirements and guidance, one acceptable approach would be to show that with the CRAVS partially or completely inoperable during the SBO event, equipment necessary for coping with the event is expected to be functional and areas requiring access are expected to be habitable under the environmental conditions resulting from the event (including consideration of partially or completely inoperable HVAC systems).
53.	SRP-UDP format item	Added "Technical Rationale" to ACCEPTANCE CRITERIA to describe the bases for referencing the acceptance criteria.
54.	SRP-UDP format item	Added lead-in statement for the "Technical Rationale."
55.	SRP-UDP format item	Added technical rationale for GDC 2.
56.	SRP-UDP format item	Added technical rationale for GDC 4.
57.	SRP-UDP format item	Added technical rationale for GDC 5.
58.	SRP-UDP format item	Added technical rationale for GDC 19.
59.	SRP-UDP format item	Added technical rationale for GDC 60.
60.	SRP-UDP format item	Added technical rationale for 10 CFR 50.63.
61.	Integrated Impact No. 324	Added reference to standard design certification review.
62.	Editorial	Replaced "safety analysis report" with "SAR," which had previously been defined.
63.	Editorial	Added abbreviation for operating license (OL).
64.	Integrated Impact No. 324	Added reference to combined license (COL) review.
65.	Editorial	Replaced "safety analysis report" with "SAR," which had previously been defined.
66.	Editorial	Added reference to technical specifications to conform to SRP Sections 9.4.3 and 9.4.4.
67.	Editorial	Added to conform to SRP Sections 9.4.2, 9.4.3, and 9.4.4.

Item	Source	Description
68.	Integrated Impact No. 323	Added reference to industry standard ASME Code AG-1 to REVIEW PROCEDURES.
69.	Editorial	Deleted sentence. Reference to review branch review responsibilities is covered in AREAS OF REVIEW.
70.	Integrated Impact No. 324	Added reference to hazardous chemical releases.
71.	Editorial	Changed wording to conform to SRP Sections 9.4.2, 9.4.3, and 9.4.4.
72.	Editorial	Changed wording to conform to SRP Sections 9.4.2, 9.4.3, and 9.4.4.
73.	Editorial	Changed to "and" because components must be protected from both internal and external missiles.
74.	Editorial	Changed to conform to SRP Section 9.4.2.
75.	Editorial	Changed to conform to SRP Section 9.4.2.
76.	Integrated Impact No. 324	Added paragraph identifying review requirement to identify, at the OL or COL review stage, contamination that may enter the control room vents, and renumbered subsequent paragraphs.
77.	Integrated Impact No. 325	Added review requirements for station blackout to AREAS OF REVIEW.
78.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
79.	Editorial	Modified to eliminate gender-specific reference.
80.	Editorial	Provided "SER" as initialism for "safety evaluation report."
81.	Conversion to SI units	Added metric units for 0.5 rem.
82.	Editorial	Added title of GDC 2.
83.	Editorial	Added title of GDC 4.
84.	Editorial	Added title of GDC 5.
85.	Editorial	Added title of GDC 19.
86.	Editorial	Added title of GDC 60.
87.	Integrated Impact No. 325	Added to 10 CFR 50.63 to acceptance criteria.
88.	Editorial	Corrected title of GDC 4.
89.	Editorial	Revised finding for consistency with relevant GDC 4 requirements reflected in subsection II and the review pursuant thereto performed in subsection III.
90.	Editorial	Corrected title of GDC 5.

Item	Source	Description
91.	Integrated Impact No. 325	Added reference to station blackout requirements of 10 CFR 50.63 to EVALUATION FINDINGS.
92.	SRP-UDP Format Item, Implement 10 CFR 52 Related Changes	To address design certification reviews a new paragraph was added to the end of the Evaluation Findings. This paragraph addresses design certification specific items including ITAAC, DAC, site interface requirements, and combined license action items relevant to the SRP section.
93.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.
94.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
95.	Integrated Impact No. 325	Added 10 CFR 50.63 to REFERENCES and renumbered subsequent References.
96.	Editorial	Corrected title of GDC 4.
97.	Integrated Impact No. 325	Added Regulatory Guide 1.155 to REFERENCES.
98.	**Integrated Impact 323**, SRP-UDP format item	Since citation of this standard was added in subsection III, listing of it as a reference was also added in accordance with SRP-UDP format guidance.

SRP Draft Section 9.4.1
Attachment B - Cross Reference of Integrated Impacts

Integrated Impact No.	Issue	SRP Subsections Affected
323	Consider revising REVIEW PROCEDURES to address conformance with ASME Code AG-1 for new applications.	III, REVIEW PROCEDURES VI, REFERENCES item 13.
324	Due to the site-specific nature of toxic substance hazards, COL applicants referencing certified standard designs must identify the site-specific toxic substance hazards and demonstrate that control room operators are adequately protected against the effects of toxic releases, in accordance with guidance and criteria currently identified in SRP Sections 6.4 and 9.4.1. Revise ACCEPTANCE CRITERIA, REVIEW PROCEDURES, AND EVALUATION FINDINGS to reflect the standard design certification and combined licensing process in reviews of CRAVS features.	III, REVIEW PROCEDURES
325	Consider the incorporation of requirements in 10 CFR Part 50, Section 50.63(a)(2), Station Blackout, into SRP Section 9.4.1 subsections as appropriate.	I, AREAS OF REVIEW Review Interfaces II, ACCEPTANCE CRITERIA, III, REVIEW PROCEDURES IV, EVALUATION FINDINGS VI, REFERENCES